

HELMINTHOLOGY.—*A review of the cestode genus Echineibothrium.* R. T. YOUNG, University of Maryland. (Communicated by E. W. Price.)

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This paper is an attempt to clarify the taxonomy of the cestode genus *Echineibothrium* (family Phyllobothriidae; type species, *minimum* van Beneden, 1850). This genus, described by van Beneden in 1850, comprises at least 18 recognizable species common in selachian hosts. It has been in need of review for some time.

Van Beneden based his genus on material from *Trygon pastinaca* (= *Dasyatis pastinaca*). Prior to his account, however, Rudolphi (1819) had described *Bothriocephalus tumidulus* (= *Tetrabothrius tumidulus*), now recognized as *Echineibothrium tumidulum* from the same host. He described the genus as having four bothridia borne on long pedicels extremely variable in form. These have regular "replis" over the whole extent of the organ which resemble the "lamelles" on the head of an *Echineis* whence the generic name. In classifying the species of *Echineibothrium* these ridges, and the consequent number and arrangement of loculi, are usually considered important; but in view of the statement of Woodland (1927, p. 520) that in *E. maculatum* the ridges separating the loculi are temporary, and that therefore the latter "are often entirely absent or at least invisible," some question arises regarding the importance of this feature in classification.

Echineibothrium is a very variable genus, which accounts largely for the confusion in classification of its species. Van Beneden (1850, p. 113) says of the bothridia that they are "extraordinairement variables dans leur forme," and Beauchamp (1905, p. 520) says: "Ni le nombre des alvéoles . . . ni la forme générale de la bothridie, ni la présence ou l'absence de myzorhynchus . . . ne sont des caractères au dessus de tout critique. Enfin le longueur du cou et la loi de croissance des anneaux sont caractères de variété d'individu plutôt que d'espèce. Il en résulte qu'il n'y a peut-être pas dans le genre une seule espèce qui puisse être nettement distinguée des autres."

This statement is perhaps somewhat exaggerated, but it emphasizes the need for caution in defining and describing species in this genus.

RELATION TO OTHER GENERA

Rudolphi (1819) described *Bothriocephalus tumidulus*, Leuckart (1819) *B. echeneis*, Diesing (1863) *Tetrabothrius sphaerocephalum*, van Beneden (1850) *Tetrabothrium variable*, Linton (1890) *Rhinebothrium*, Shipley and Hornell (1906) *Tiarobothrium*, and Baer (1948) *Caulobothrium*, all of which are probably synonymous with *Echineibothrium*. Joyeux and Baer (1936) recognized the synonymy of the latter with *Rhinebothrium*, as did Southwell (1925), but Baer (1948) accepted *Rhinebothrium* as a genus distinct from *Echineibothrium*, splitting the latter into three genera, viz: *Echineibothrium* proper, *Rhinebothrium*, and *Caulobothrium*. According to this author (l.c., p. 83) the first of these is restricted to European forms, while the two latter occur in *Dasyatis centroura* from Woods Hole, Mass. In the European species a myzorhynchus is always present, while in the specimens from Woods Hole there is never the "moindre trace" of one. Beauchamp (l.c., p. 520) says the myzorhynchus can be "complètement invisible quand il est rétracté et ne crée pas alors un élargissement particulier de la tête." And Joyeux and Baer (l.c.) speak of a "petit" myzorhynchus in *E. minimum*, *tumidulum*, and *julievansium*, while van Beneden (l.c.) says that in the first of these it is "peu développé." Its value therefore as a specific, much less a generic character, is questionable.

Baer (l.c., p. 98) defines *Rhinebothrium* as lacking testes between the genital atrium and the ovary on the poral side of the proglottid. But on page 94 he apparently contradicts himself by stating that "les testicules . . . contrairement à ce que nous avons observé dans les autres espèces, occupent toute la face dorsale de l'anneau jusqu'à l'ovaire . . . en arriere de l'atrium genitale et des testicules se trouvent toujours entre celui-ci et

l'ovaire dans la moitié porale du segment" (italics are the writer's). In *Caulobothrium* the testes occupy this space. In *Rhinebothrium* the longitudinal musculature is reduced to a single subcuticular layer, while in *Caulobothrium* there is, in addition to the subcuticular layer, a parenchymal layer outside of the vitellaria but within the subcuticular layer. In *Rhinebothrium* the vitellaria are restricted to two lateral bands, while in *Caulobothrium* they encroach laterally on the dorsal and ventral faces of the medullary parenchyma (p. 96). In the writer's opinion these differences are not sufficient to divide the genus *Echeneibothrium* into three genera.

Echeneibothrium approaches most nearly to *Anthobothrium*, and the relationship is strengthened by the fact that in at least one species of the latter genus, *Spongiobothrium variable* (Linton, 1889) (= *Anthobothrium variable*) the bothridia have a series of incomplete divisions resembling the loculi of the former.

Discobothrium fallax van Beneden, 1871, has been referred by Monticelli (1890) to *Echeneibothrium variable*, a reference supported by Olsson (1893) but opposed by Lönnberg (l.c.), who maintained the distinctness of the two species.¹ Southwell (l.c.) regards it as an interesting link between the Tetraphyllidea and the Cyclophyllidea, but in 1930 he considers *Discobothrium* and *Echeneibothrium* to be distinct.

Yamaguti (1934), recognizing the genus *Discobothrium*, includes in it the species *japonicum*, (which he describes as new) from *Narke japonica*. Braun (1894-1900) considers *D. fallax* a valid species on the basis of Lönnberg's opinion. It is also listed as a distinct species by Joyeux and Baer (l.c.). These authors give the absence of bothridia as one of the characters of the Cephalobothriidae, although they describe the "quatre petites ventouses situées en arrière" of the myzorhynchus which may perhaps represent reduced bothridia. Wardle and McLeod (1952, pp. 283-4) describe "four bothridia (at the

base of the holdfast) borne on long stalks and very mobile." They list *fallax* as a distinct species in the genus *Echeneibothrium*, considering the "resemblance between *fallax* and *Echeneibothrium variable* . . . sufficiently close to make the inclusion of *fallax* within the genus imperative" (p. 240). Beauchamp (l.c., p. 521) agrees with Lönnberg, and Woodland (l.c., p. 532) considers "*Echeneibothrium variable* . . . definitely distinguished from *Discobothrium fallax* on anatomical grounds", the latter being renamed *E. fallax* in which the bothridia "usually show but few indications of loculi" (l.c., p. 523). Though Beauchamp (l.c., p. 509) says of the bothridium that "il ne présente aucune espèce d'alvéoles ou de replis transversaux" yet it is a fact that "very distinct loculi are often to be found." (Woodland, l.c., p. 524). Southwell (l.c., p. 336) says that while he was unable to obtain a specimen of *fallax* "there is little . . . doubt that the genera *Discobothrium* and *Echeneibothrium* are different but closely related."

In view of these conflicting opinions the writer considers it best to place *Discobothrium fallax* among genera and species inquirendae.

LIST OF SPECIES

1. *Echeneibothrium flexile* (Linton, 1890)

This species was described as *Rhinebothrium flexile* in *Trygon centrura* (= *Dasyatis centrura*) from Woods Hole, Mass. There are 38-42 loculi in the bothridia which are borne on long stalks and characterized by a hinge in the middle, giving the appearance of two bothridia on one stalk. The bothridial halves face each other when contracted. A myzorhynchus is apparently absent. Testes 10 in number. Ovarial lobes very long "extending nearly to the middle of the segment" (Linton l.c., p. 770).

2. *Echeneibothrium variable* van Beneden, 1850

This species, from *Raja clavata*, *R. batis*, and *R. rubus*, is characterized by a definite myzorhynchus. According to van Beneden the strobile reaches a length of 100 mm, with at least 100 segments, but Beauchamp (l.c.) gives the length as only 25-30 mm with many fewer segments. Joyeux and Baer (l.c.) give the number of testes as 20-27, but in figure 14, plate 3, of his

¹ This statement is based on one by Southwell (l. c., p. 335). While Lönnberg lists ?*Discobothrium fallax* and *Echeneibothrium variable* specifically he makes no statement as to whether these are the same or different species and is apparently in doubt about this.

1850 publication van Beneden shows only 16 testes. The cirrus sack is very long (22 mm), reaching the middle of the segment. The bothridia are rather strongly pedunculate, with approximately 8 loculi according to Linton (l.c.), but van Beneden's figure 6, plate 3 (1850), shows 20 loculi. The cirrus is spined according to Linton (1889), or "couvert des mêmes asperités" according to van Beneden (1850, p. 117). Linton considers this species synonymous with *Echeneibothrium sphaerocephalum* of Diesing (1863).

3. ***Echeneibothrium tumidulum*** (Rudolphi, 1819)
Syn. *Bothriocephalus tumidulus*.

From *Trygon* (= *Dasyatis*) *pastinaca*.

Rudolphi's account of *Bothriocephalus tumidulus* is so brief as to render identification difficult. He apparently had only segments to examine. The bothridia have one long, and several transverse septa and are swollen. According to Dujardin (1845, p. 620) the bothridia are sometimes "puisque contigues, réunies en une masse globuleuse, quelquefois . . . divisés chacun en deux lobes pétaloïdes, oblongues et plissés." These differences emphasize the variable form of the worm, any given specimen reflecting the form at the moment of fixation.

Carus (1885) identifies it with both *E. variable* and *E. minimum* and with *Bothriocephalus echeneis* of Leuckart (1819). Southwell (1925) considers it identical with *E. variable*. Wardle and McLeod (l.c., p. 240) describe it as "an extremely variable form . . . (including) all the non-rostellate forms in which each bothridium has a double series of loculi." They, however, and Joyeux and Baer (l.c.) recognize it as a distinct species, but Baer (l.c., p. 90) finds it "une espèce collective qu'il est impossible de reconnaître, which is the view of the writer.

4. ***Echeneibothrium longicolle*** (Linton, 1890)
Syn. *Rhinebothrium longicolle*.

This species, from *Myliobatis freminvillei* and *Dasyatis centrura*, is characterized by the large number of testes (150-180) and by the long, well-marked neck, which Baer (l.c., p. 93) defines as a "pédoncule céphalique (whose structure histologique est bien la même que celle du scolex et non que celle du strobile, (and by) une puissante musculature longitudinale . . . interne du parenchyme corticale . . . in addition to the subcuticular muscles of other species. The

cirrus pouch is very long and narrow (0.35-0.36 by 0.037-0.073 mm). In its well-defined neck it resembles *Echeneibothrium urobatidium* (Young, 1955), but as stated there it differs in many important respects from the latter.

5. ***Echeneibothrium palombii*** (Baer, 1948)
Syn. *Rhinebothrium palombii*.

This species from *Dasyatis violacea* is characterized by the single row of 20-22 loculi, by the size of its cirrus sack (0.36 mm long) and by the number of testes (95-100).

6. ***Echeneibothrium maccallumi*** (Linton, 1924)
Syn. *Rhinebothrium maccallumi*.

This species, from *Dasyatis centrura*, is characterized by its few testes (4 or 5), although Southwell (1925) considers it synonymous with *E. tumidulum*, which has 20-25 testes according to Joyeux and Baer (l.c.).

7. ***Echeneibothrium burgeri*** (Baer, 1948)
Syn. *Rhinebothrium burgeri*.

Baer does not give the host of this species, merely stating that it was collected at Woods Hole. According to him it is very near *E. flexile*. The difference in number of testes (30-35 in *burgeri* vs. 14-18 in *flexile*), however, would seem to be distinctive, unless this is a matter of development solely.

8. ***Echeneibothrium shipleyi*** (Southwell, 1912)
Syn. *Rhinebothrium shipleyi*.

Southwell first reported this as a distinct species from *Trygon* (= *Dasyatis kuhli*). Later (1925) he relegated it to synonymy with *Echeneibothrium minimum* because of transverse septa only in the bothridia. Yamaguti (1934, p. 63), however, "on the basis of material from *Dasyatis akajei* which corresponds to Southwell's original description" held that his species was "unquestionably valid." There is no myzorhynchus or neck. Southwell (1930, p. 215) states that "immediately posterior to the head (there) is a swollen bulbous portion, triangular in shape, with the apex passing into the proglottides."

Since *E. shipleyi* has 130 segments, whereas *E. minimum* has only 15, and has over 40 testes, while minimum has about 20 only, the writer agrees with Yamaguti.

9. *Echeneibothrium cancellatum* (Linton, 1890)
Syn. *Rhinebothrium cancellatum*.

This species from *Rhinoptera javanica* has three rows of loculi in the bothridia which are mounted on short pedicels, two lateral rows and one median, producing about 21 loculi. Southwell (1925) and Wardle and McLeod (l.c.) accept this species as valid, but some doubt as to its status arises from the observations of Woodland on *Echeneibothrium maculatum*. And Linton himself says (p. 772) "I am in doubt as to whether the number of loculi is always constant." But he goes on to say (p. 775) "the difference between the bothria of *R. cancellatum* and *E. tumidulum* is too profound to admit of reconciliation. No median row of loculi occurs in any of the published figures of *E. tumidulum* . . . while in *R. cancellatum* it is very evident." The cirrus pouch extends a little past the median line, enlarging at its interior end where its diameter nearly equals the segment length. The cirrus is heavily spined, especially at the base, where some of the spines are 0.008 mm long by 0.003 mm broad with sharply recurved and hooked ends. In this respect it suggests *E. minimum*, but the arrangement of the loculi in the bothridia is apparently very different. This and the heavily spined cirrus appear to determine it as a valid species.

10. *Echeneibothrium trifidum* Shipley
and Hornell, 1906

This species, from *Trygon walga* (= *Dasyatis walga*), is characterized by the Y-shaped bothridia with the anterior half cleft longitudinally and divided into 9 loculi in each half, while the basal part has 9 also or 27 in all, viz; 9 large and 18 small. The bothridia are stalked and there is no myzorhynchus.

11. *Echeneibothrium minimum* van Beneden, 1850

This species from *Trygon pastinaca* (= *Dasyatis pastinaca*) has been given as the type of the genus *Echeneibothrium* by Southwell (1925) and Braun (1894-1900), although, so far as the writer can discover, van Beneden did not specify any species as a generic type. He described it as 15-17 mm long and so "grêle" that it was with difficulty discernible to the naked eye. It has only 15 segments. The bothridia are divided "en 8 ou 10 lames qui peuvent se séparer au milieu." A characteristic feature are the heavy spines on the base of the cirrus. "Le bulbe, qui est situé au

milieu des quatre appendices, est en générale peu prononcé dans cette espèce. Des plis se forment sur toute la longueur des bothridies, et se divisent parfois au milieu par un profond sillon."

12. *Echeneibothrium rankini* (Baer, 1948)
Syn. *Rhinebothrium rankini*.

Baer does not record the host of the single specimen on which he based his description further than stating that it came from Woods Hole. He says it most nearly resembles *shipleyi*, both species having a single row of loculi. He considers it to be distinguished "facilement de toutes les autres du genre" (l.c., p. 88), distinguishing it mainly by the size of the cirrus pouch "qui est presque deux fois plus grande chez *R. shipleyi* que chez *R. rankini*." The proportions which he gives in his table on p. 98 however do not bear out his statement. In *shipleyi* the pouch measures 0.4/0.024 mm, while in *rankini* it measures 0.216/0.09. These figures indicate that in the former the pouch was more extended, while in the latter it was more compressed. Were the shape of the pouch in each species similar it is most likely that the size (i.e., volume) in each would be similar. For this reason, and because Baer's description was based on a single specimen, the writer considers it probable that the two species are identical.

13. *Echeneibothrium julievansium* Woodland,
1927

This species, from *Raja maculata*, based on a single immature specimen, was differentiated from *E. variable* by the shape of the progottids and the presence of two pairs of excretory vessels, which latter fact was, in Woodland's opinion, "sufficient to disprove the identity" of these two species. In *variable* there is, according to Woodland, only a single vessel, which is unusual in cestodes, the presence of two pairs of vessels being the usual arrangement. This suggests the possibility of a mistake by Woodland in overlooking the dorsal vessels in *variable*, they being small and in some cases difficult to detect. Joyeux and Baer (l.c.) recognize *E. julievansium* as a valid species which, according to them, is characterized "par le fait que les quatre bothridies sont globuleuses." (p. 87). It is also recognized by Wardle and McLeod (l.c.) on the basis of its suckerlike bothridia. Not having seen any specimens the present writer hesitates to give it a

definite status, preferring to place it in the class of species inquirendae.

14. *Echeneibothrium maculatum* Woodland, 1927

A prominent, permanent "rostellum" (myzorhynchus) is given by Woodland as a characteristic of this species from *Raja maculata*. This has, however, been described for several other species, and, as van Beneden (1850) and Beauchamp (l.c.) have pointed out, the variability of this organ, and the uncertainty even as to its presence, militate against its use as a means of specific determination. The writer finds no character sufficiently definite to determine this as a distinct species, and it is accordingly relegated to the group of species inquirendae.

15. *Echeneibothrium austrinum* Linton, 1924

Linton gives the host of this species as a "large skate (from) Mossel Bay." Southwell (1925) considers it identical with *E. tumidulum*. Linton describes it as having a myzorhynchus and a subglobular scolex with the "bothria united at base, . . . nearly circular in outline and provided with small loculi" (p. 14) indeterminate in number. There is no neck. The cirrus is "armed with closely set spines. Vitellaria massive at side mainly in front of the level of the cirrus pouch, but also continuing to the end of the proglottides" (p. 15). The length of two strobiles was 24 and 32 mm, respectively, while two scolices measured 0.21 and 0.26 mm in diameter. In the writer's opinion there is nothing distinctive in Linton's description and he believes this form should be placed among species inquirendae.

16. *Echeneibothrium insignia* (Southwell, 1911)
Syn. *Rhinebothrium insignia*.

In his monograph Southwell (1925) stated that on reexamination of his material he believed this species from *Trygon* (= *Dasyatis*) *warnak* to be identical with *Echeneibothrium flexile*, but Baer (l.c., p. 95, footnote 1) has pointed out that Southwell's figure 138 is totally different from his figure 139 in the form of the ovary, and especially in the number and distribution of the testes, though both of these figures refer to *E. flexile* (= *R. insignia*). In the light of these uncertainties the writer is inclined to refer *insignia* to species inquirendae.

17. *Echeneibothrium javanicum* Shipley and Hornell, 1906

This species is described by these authors as 9–12 mm long with a neck that occupies one-third to one-half the length of the strobile, pedunculate bothridia divided into 29 loculi by two long, and several transverse ridges, lacking a myzorhynchus and with a cirrus minutely spined. In its three rows of loculi it resembles *E. cancellatum*, both from the same host, *Rhinoptera javanica*, but the heavily spined cirrus of *cancellatum* distinguishes clearly between these two species.

18. *Echeneibothrium hornelli*, new name for *T. javanicum* Shipley and Hornell, 1906
Syn. *Tiarabothrium javanicum*.

This species is described as 11–12 mm long with sessile bothridia divided into 12 loculi by transverse septa only. The neck has a definite collar and the cirrus is minutely spined. It also is a parasite of *Rhinoptera javanica*. Regarding it Southwell (1925, p. 212) says: "the species . . . appears to be indistinguishable from *E. minimum* . . . except that in the former there is a well-developed myzorhynchus", apparently overlooking the characteristic cirrus in the latter species. The description of this species is inadequate for a comparison with others and the writer accordingly refers it to the list of species inquirendae.

19. *Echeneibothrium trigonis* Shipley and Hornell, 1906

In this species from *Trygon walga* (= *Dasyatis walga*) the bothridia are sessile and are divided into 7 or 8 loculi by transverse partitions only. It varies in length from 8 to 15 mm. The "stout, unsegmented neck is a good deal broader than the succeeding segmented parts" (p. 81). The authors do not describe the cirrus or give the testes number so that an exact comparison with other species is impossible.

20. *Echeneibothrium myzorhynchum* Hart, 1936

This species, from *Raja binoculata*, is defined by the author as possessing a well-developed myzorhynchus, pedunculate bothridia with ten transverse loculi and ten or twelve testes located in the anterior part of the proglottid. It has a maximum length of 15 mm, with 64 distinct proglottids. The author states (p. 495) that it "is separated from all species of *Echeneibothrium*

excepting *E. minimum* . . . by the fact that the bothridia are divided only by transverse septa," but his figure 6 shows a longitudinal septum very clearly, with nine pairs of loculi and two at the ends, making 20 in all. In its large myzorhynchus and cirrus sack it resembles *E. variabile* but is smaller (15 mm and 64 proglottids compared with 35–70 mm, according to Joyeux and Baer, and at least 100 segments according to van Beneden in *variabile*). Hart does not give the number of specimens examined by him, so that it is doubtful how comprehensive his data are. Another similarity between *myzorhynchum* and *variabile* is the spiny cirrus.

Whether the differences in size and testis number are sufficient to separate these two species is, in the writer's opinion, doubtful, so that he prefers to relegate *myzorhynchum* to species inquirendae.

21. *Echeneibothrium dubium* van Beneden, 1858

From *Raja batis*. Van Beneden lists the characters separating *E. dubium* from *E. minimum* and *E. variabile* as follows: (1) In *dubium* the bothridia are borne on long peduncles and have few (6–8) areolae; (2) the myzorhynchus is more slender than in *variabile*; (3) the form of the spines on the cirrus is different from that in *minimum* and *variabile*; (4) it occurs in a different host. In van Beneden's figures 3 and 12 the spines on the cirrus of *E. dubium* are shown in comparison with those of *E. minimum*. Both are of about the same length, those of the latter being somewhat stouter. Whether these differences are sufficient to separate the two species is, in the opinion of the writer, doubtful, and he is therefore in agreement with Southwell (1925) who considers *dubium* and *minimum* synonymous, in spite of the opinion of Joyeux and Baer (l.c.) who consider *dubium* a distinct species.

22. *Echeneibothrium sphaerocephalum* (Deslongchamps, 1824)

Syn. *Bothriocephalus sphaerocephalus*.

According to Diesing (1863) this species, from *Raja clavata*, has oval, pedunculate, multiloculate bothridia, with transverse septa and a spherical myzorhynchus. It measures 25–50 mm. No figure is given and, from the brief account, identification is impossible.

23. *Echeneibothrium gracile* Zschokke, 1889

This species, from *Dasyatis clavata*, measures

up to 12 mm in length. The bothridia are borne on short, thick stalks and are divided into 14–18 loculi by a longitudinal and several transverse septa. There is a short, swollen myzorhynchus. The cirrus pouch extends to the middle of the segments, which are 30–50 in number. The end of the cirrus is spined. There are not over 25 large testes situated in front of the genital ducts. In the absence of any distinguishing features the writer regards this as one of species inquirendae.

24. *Echeneibothrium tobigei* Yamaguti, 1934

According to Baer (l.c.) this species, from *Myliobatis tobigei*, is very close to, if not identical with *Rhinebothrium longicolle*, the presence of a vaginal sphincter in the latter and its absence? in the former being apparently the only distinguishing? feature. Length of neck (36 mm in *tobigei*, 7 mm in *longicolle*) is another difference, but to what extent this was determined by the state of contraction or expansion in specimens of the two species is uncertain. According to Yamaguti the bothridia have transverse partitions only which would seem to separate it from *longicolle*, but his figure 92, page 61, shows a double row with a median partition. The testis number is 140–160. In the writer's opinion the two are synonymous.

25. *Echeneibothrium ceylonicum*, Shipley and Hornell, 1906

In this species, from *Trygon walga* (= *Dasyatis walga*), the bothridia are mounted on short stalks and have 14 loculi. It has a neck of fair length, and the strobile is 8 to 25 mm long. The gonopore is "median." Southwell (1925) identifies it with *tumidulum*. Since the latter is probably a complex of species it is fairly safe to identify it with any one of a number of others.

26. *Echeneibothrium ceylonicum* (Shipley and Hornell, 1906)

Syn. *Rhinebothrium ceylonicum*.

The second of these species from *Trygon* (= *Dasyatis*) *Kuhli* and *T. walga* is described as having the bothridia mounted on very short stalks "if indeed they exist at all. Each bothridium is divided by a long and several transverse partitions into about 20 loculi. Southwell (1925) places it in *Phyllobothrium lactuca*, the production of apparent areolae being due to the "folding and frilling of the somewhat thickened margin of the bothridium in precisely the manner shown by van

Beneden" in the latter species. These two species, *E. ceylonicum* and *R. ceylonicum*, are, in the opinion of the writer, synonyms and homonyms, and since *R. ceylonicum* has priority over *E. ceylonicum*,² the former name must stand for both species which, in the writer's judgement, lack any characteristic features and are therefore relegated to the status of species inquirendae

27. *Echeneibothrium affine* Olsson, 1867

This species from *Raja radiata* and *R. batis* is also, in the writer's opinion, not well enough defined to entitle it to specific rank. It is therefore allocated to species inquirendae.

28. *Echeneibothrium walga* Shipley and Hornell, 1906

One specimen only, which was ripe, was found by these authors in *Trygon* (= *Dasyatis*) *walga*. It was 7 mm long. Each bothridium is hinged in the middle similar to those of *E. flexile*, and each is divided by a long and several transverse partitions into about 24 loculi. While only a single specimen was available for study the hinged bothridia apparently make this identical with *E. flexile*, which is the view of Southwell (1925, 1930).

29. *Echeneibothrium myliobatis-aquilae* Diesing, 1863

Neither Diesing or Wedl (1855) gives any account of this species other than a description of the eggs. Zschokke (1889) found fragments of a worm in *Myliobatis aquila* which he thought might belong to this species, but he could not definitely locate it in *Echeneibothrium*.

30. *Tritaphros retzii* Lönnerg, 1889

This species, from *Raja clavata*, is considered by Southwell (1925) as possibly synonymous with *E. tumidulum*, but a comparison of his figures 132 and 133 shows at a glance the improbability of such a comparison. It may be identical with *Trilocularia gracilis* (Olsson 1869).

31. *Echeneibothrium* sp. Beauchamp, 1905

This species, from *Raja punctata* and *R. macrorhynchus*, is characterized by a large, extremely variable myzorhynchus. In certain aspects it resembles *E. dubium* of van Beneden (1858) but differs therefrom in the number of its loculi and segments. The bothridia are "à peu près semblables" to those of *E. variable*, but

² See Shipley and Hornell (l. c., pp. 71 and 82).

when elongated their transverse folds may disappear (p. 525). The loculi are 6 or 7 in number on each side. The neck, separated from the strobile by a slight constriction, is "très grêle ainsi que le corps." No details of internal structure are given and, in the light of Beauchamp's uncertainty as to its classification and the lack of more adequate data, the writer must relegate it to the list of species inquirendae.

32. *Echeneibothrium simplex* Shipley and Hornell, 1906

In this species, from *Trygon walga* (= *Dasyatis walga*), the loculi are restricted to the borders of the bothridia. Southwell (1925) considers it synonymous with *Anthobothrium, variable* an opinion with which the writer concurs.

33. *Echeneibothrium bifidum* Yamaguti, 1952

This species is of interest as the only one recorded thus far in teleosts, to the writer's knowledge. He has, however, found specimens of the genus in an *Atherinops* in southern California and in toadfish (*Opsanus tau*) in the Gulf of Mexico and Chesapeake Bay, the latter of which is awaiting description. It seems remarkable that there are not more records of the genus in teleosts, since it occurs commonly in selachians which prey upon the latter.

Yamaguti's description was based on a single specimen from *Trachurus trachurus*. In its 12-13 transverse, and two longitudinal septa in the bothridia it suggests *E. cancellatum*, but the bilobed bothridia set it apart from that or any other species known to the writer with the possible exception of *E. flexile* and of *E. bi-lobatum* Young, 1955.

34. *Echeneibothrium multorchidum* Young, 1954

This species occurs in the stingray (*Urobatis halleri*) in southern California. It is characterized by the number of testes together with the stalked bothridia which are divided into about 38 loculi by one long, and several transverse partitions. There is no evident myzorhynchus. It shows considerable resemblance to *Rhinebothrium burgeri* (Baer, 1948), but differs from the latter in size and in number of loculi (38 vs. 48-50 in *burgeri*). Available specimens of *E. multorchidum* were not ripe, but it apparently is much shorter and has fewer segments than the former.

35. *Echeneibothrium urobatidium* Young, 1955

This species also occurs commonly in the

stringray. It is apparently one of the complex hitherto included in the species *E. tumidulum* but differs from the published accounts of the latter in three respects: (1) Form of strobile. In *tumidulum* the anterior proglottids are conspicuously wider than long, while in *urobatidium* the difference is not nearly so noticeable. (2) The number of proglottids is much smaller in the latter than in the former (about 50 in *urobatidium*, over 200 in *tumidulum*). (3) The testes are 10-12 in *urobatidium*, 20 in *tumidulum*. In its distinct neck it resembles *Echeneibothrium longicolle* but differs from the latter in testis number and in other important respects.

36. *Echeneibothrium bilobatum* Young, 1955

This curious little species from *Urobatis halleri*, a description of which was based on a single immature specimen, resembles *E. flexile* and *E. bifidum* in the bi-lobed bothridia. The two lobes however are different in size, which clearly sets it off from either. It is peculiar in the small number of testes judging from the single specimen available, which are arranged in a single line. In this respect it resembles *E. maccallumi* but differs from the latter in its bi-lobed bothridia and in other ways. It is similar to *E. minimum* and *E. shipleyi* in having transverse septa only in the bothridia, but is very distinct from them in other respects. There is no evident myzorhynchus or distinct neck. There were about 25 proglottids in the specimen observed.

37. *Echeneibothrium* sp.

An *Echeneibothrium* occurs commonly in the toadfish reference to which has already been made.³ The cysts containing the scolices are located mostly around the rectum. The bothridia have transverse septa only dividing them into about 22 loculi and are borne on stalks about one-half the length of the bothridia themselves.

38. *Echeneibothrium octorchis* Riser, 1955

This species, from *Raja montereyensis*, is characterized by its few (7-9) testes and small strobile. It has 10 loculi in the bothridia which are armed, as are the pedicels, with small curved hooks. The cirrus is covered with fine hairs.

39. *Echeneibothrium dolichoophorum* Riser, 1955

This species, from *Raja rhina*, is characterized by its large myzorhynchus and the long, narrow ovarian wings. The bothridia are 10-loculate.

40. *Echeneibothrium macrascum* Riser, 1955

In this species from *Raja montereyensis* the pedicels are attached to the posterior borders of the bothridia. There is a massive cirrus sack and a long, much-coiled ejaculatory duct.

SYNONYMY

The following table gives the various synonymies found in the literature:

Echeneibothrium flexile:

Rhinebothrium flexile Linton, 1890
Rhinebothrium insignia Southwell, 1911
Echeneibothrium walga Shipley and Hornell, 1906

Echeneibothrium tumidulum:

Bothriocephalus (Tetraboehrium) tumidulus Rudolphi, 1819
Bothriocephalus echeneis Leuckart, 1819
Echeneibothrium variabile van Beneden, 1850
Echeneibothrium affine Olsson, 1867
Echeneibothrium gracile Zschokke, 1889
Echeneibothrium ceylonicum Shipley and Hornell, 1906
Echeneibothrium austrinum Linton, 1924
Echeneibothrium minimum van Beneden, 1850
Rhinebothrium maccallumi Linton, 1924
Rhinebothrium longicolle Linton, 1890
Tritaphros retzii Lönnberg, 1889
Petaloecephalus tumidulus

Echeneibothrium walga:

Rhinebothrium flexile Linton, 1890

Echeneibothrium insignia:

Caulobothrium insignia Baer, 1948
Rhinebothrium insignia Southwell, 1911
Echeneibothrium flexile

Echeneibothrium minimum:

Echeneibothrium sphaerocephalum (Deslongchamps, 1824), Diesing, 1863
Echeneibothrium trigonis Shipley and Hornell, 1906
Tiarabothrium javanicum ibid.,
Rhinebothrium shipleyi Southwell, 1912
Rhinebothrium palombii Baer, 1948
Echeneibothrium dubium Beneden, 1858
Anthobothrium ceylonicum Southwell, 1912

Echeneibothrium cancellatum:

Rhinebothrium cancellatum Linton, 1890
Echeneibothrium javanicum Shipley and Hornell, 1906

Echeneibothrium sphaerocephalum:

Bothriocephalus sphaerocephalus Deslongchamps, 1824
Tetraboehrium sphaerocephalum Diesing, 1863
Echeneibothrium variabile van Beneden, 1850

³ See p. 256.

Echeneibothrium variabile:*Echeneibothrium sphaerocephalum* Diesing, 1863*Bothriocephalus echeneis* Leuckart, 1819*Tetraphothrium variabile* (van Beneden, 1850), Diesing, 1854*Echeneibothrium tobigei*:*Rhinebothrium longicolle* Linton, 1890*Echeneibothrium simplex*:*Anthobothrium variabile* (Linton, 1889), Southwell, 1925*Echeneibothrium longicolle*:*Rhinebothrium longicolle* Linton, 1890*Caulobothrium longicolle* Baer, 1948*Echeneibothrium ceylonicum*:*Rhinebothrium ceylonicum* Shipley and Hornell, 1906; *Phillobothrium lactuca* Beneden, 1850*Echeneibothrium palombii*:*Rhinebothrium palombii* Baer, 1948*Echeneibothrium fallax*:*Discobothrium fallax* Beneden, 1871*Echeneibothrium variabile* (Monticelli, 1890)*Echeneibothrium maccallumi*:*Rhinebothrium maccallumi* Linton, 1924*Echeneibothrium tumidulum* Rudolphi, 1819*Echeneibothrium burgeri*:*Rhinebothrium burgeri* Baer, 1948*Echeneibothrium shipleyi*:*Rhinebothrium shipleyi* Southwell, 1912*Echeneibothrium minimum**Echeneibothrium rankini*:*Rhinebothrium rankini* Baer, 1948*Echeneibothrium austrinum*:*Echeneibothrium tumidulum*.

SUMMARY

In this paper a discussion has been given of the genus *Echeneibothrium*, its relation to other genera, and a list of species hitherto described, 18 of which are recognized by the writer. The following key should aid in their identification.

- Bothridia hinged..... (1) *flexile*
 Bothridia not hinged.....A
 A. Bothridia lobed.....B
 Bothridia not lobed.....C
 B. Lobes equal..... (2) *bifidum*
 Lobes unequal..... (3) *bilobatum*
 C. Bothridia tripartite..... (4) *trifidum*
 Bothridia entire.....D
 D. Bothridia with transverse partitions only...E
 Bothridia with both transverse and long partitions.....G

- E. Base of cirrus with heavy spines, 15 segments (5) *minimum*
 Base of cirrus without such spines.....F
 F. 10 loculi,⁴ about 40 testes..... (6) *shipleyi*
 20-22 loculi,⁴ 95-100 testes..... (7) *palombii*
 G. Myzorhynchus large⁵.....H
 Myzorhynchus absent or small.....I
 H. Testes more than 16..... (8) *variabile*
 Testes less than 16, ovary with long wings (9) *dolichocephorum*
 I. Bothridia with loculi in 3 rows.....J
 Bothridia with loculi in 2 rows.....K
 J. Cirrus heavily spined..... (10) *cancellatum*
 Cirrus minutely spined..... (11) *javanicum*
 K. Testes more than 100..... (12) *longicolle*
 Testes less than 100.....L
 L. Testes 30 or more.....M
 Testes less than 30.....N
 M. Bothridia with 48-50 loculi,⁴ length 8 mm (13) *burgeri*
 Bothridia with 38 loculi,⁴ smaller (14) *multorchidium*
 N. Testes 20-23..... (15) *macrascum*
 Testes 10-12..... (16) *urobatidium*
 Testes 7-9..... (17) *octorchis*
 Testes 4 or 5..... (18) *maccallumi*

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⁴ See p. 256.⁵ While the variability of the myzorhynchus militates against its use in classification, it seems to be the best means for this purpose here.

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The practical man is the man who practices the errors of his forefathers.—
HUXLEY.